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10/820,525	04/07/2004	Qingguo Wu	NOVLP091/002889	8337

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EXAMINER	
MALDONADO, JULIO J	

ART UNIT	PAPER NUMBER
2823	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/820,525	WU ET AL.	
	Examiner	Art Unit	
	JULIO J. MALDONADO	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 July 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9,12-17,19-31,34 and 35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9,12-17,19-31,34 and 35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *03/12/2008*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. Applicants' cancellation of claim 18, as set forth in the reply filed on 07/30/2008 is acknowledged.

2. Claims 1-9, 12-17, 19-31, 34 and 35 are pending in the application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-9, 12-17, 19-31, 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hyodo et al. (U.S. 7,064,088 B2, hereinafter Hyodo) in view of Rhee et al. (U.S. 7,087,271 B1, hereinafter Rhee).

In reference to claims 1, 12, 17, 19, 24, 34 and 35, Hyodo teaches a method of forming a low-k dielectric layer to reduce capacitance in multi layered wiring structures (Hyodo, column 1, lines 29 – 37) including the steps of providing a substrate in a deposition chamber (Hyodo, column 11, lines 2 – 5); providing a precursor to the deposition chamber (Hyodo, column 4, lines 9 – 12); igniting and maintaining a plasma in a deposition chamber using radio frequency power having high frequency and low frequency components (Hyodo, column 13, lines 13 – 19), wherein about 1%-50% percent of total radio frequency power is provided by the low frequency component (Hyodo, column 13, lines 29 – 32), which has a frequency of between about 2 MHz or

less (Hyodo, column 13, lines 32 – 33); and depositing the low-k dielectric layer (Hyodo, column 4, lines 13 – 17) under conditions in which the dielectric layer has a stress labeled residual tensile or compressive stress of about 0 to about 300 MPa and wherein the dielectric constant of the carbon doped oxide dielectric layer is less than 4 (Hyodo, column 14, lines 65 – 67).

Hyodo further discloses controlling low frequency power to control the stress within said layer (Hyodo, column 3, lines 31 – 34), controlling the residence time of said precursor to control the dielectric constant (Hyodo, column 9, lines 41 - 45) and adding additive gases to optimize the stress within said layer (Hyodo, column 13, lines 51 - 58).

Hyodo fails to expressly disclose wherein at least about 2 percent of total radio frequency power is provided by the low frequency component, which has a frequency of between about 100kHz and 600kHz, wherein the dielectric layer has a compressive stress less than about 35 MPa and wherein the dielectric constant is not greater than 3.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in Hyodo to form a dielectric layer at the overlapping low frequency, stress and dielectric constant to arrive at the claimed invention.

Still, Hyodo fails to expressly disclose wherein said low-k dielectric layer is a carbon doped oxide dielectric layer.

However, Hyodo teaches wherein said precursor comprises a silicon-containing hydrocarbon compounds having the general formula $Si_{\alpha}O_{\beta}C_{\chi}H_{\gamma}$, wherein α, β, χ and γ are integers (Hyodo, column 4, lines 35 – 36), wherein said silicon containing hydrocarbon comprises cyclic compounds having c=c bonds (i.e., unsaturated) (Hyodo, column 5, line 15 – column 6, line 20), linear compounds having c=c bonds (i.e., unsaturated) (Hyodo, column 6, line 29 – column 8, line 40). Furthermore, Hyodo teaches wherein said precursor further includes an additive gas such as ethene (C_2H_4) (Hyodo, column 13, lines 51 – 67) and a carrier gas selected from the group consisting of N_2, He, Ne and Ar (Hyodo, column 13, lines 41 – 42).

Having this in mind, the disclosed specification teaches wherein the precursors comprise silanes, alkylsilanes, alkoxysilanes, and cyclic siloxanes (page 12, paragraph [0047]) and small molecules having 2 to 6 carbon atoms and one or more carbon-carbon double bonds or carbon-carbon triple bonds (page 14, paragraph [0068]).

Therefore, in light of the specification, the precursors of Hyodo are labeled carbon doped precursors and the dielectric layer of Hyodo is labeled a carbon doped dielectric layer.

Therefore, Hyodo teaches the same materials (i.e., unsaturated silicon-containing hydrocarbon precursors) and said materials are treated the same way (i.e., plasma deposition process at overlapping conditions), the low-k dielectric layer is labeled carbon doped oxide dielectric layer.

Hyodo substantially teaches all aspects of the invention including wherein the carbon doped oxide precursor has the general formula $Si_{\alpha}O_{\alpha-1}R_{2\alpha-\beta+2}(OR')_{\beta}$, wherein α is

an integer of 1-3, β can be 0 and R is C_{1-6} hydrocarbon attached to Si and R' is C_{1-6} unattached to Si. Hyodo fails to disclose wherein the carbon doped oxide precursor comprises at least one carbon-carbon triple bond, such as ethynyltrimethylsilane.

However, Rhee teaches a related method to form low dielectric constant layers teaches providing a substrate in a CVD chamber; introducing carbon doped oxide precursor into the chamber; and depositing said low-k dielectric layer, wherein said carbon doped oxide precursor is selected from a group including ethynyltrimethylsilane (Rhee, column 3, lines 38 – 52).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Hyodo and Rhee to enable depositing the low-k dielectric layer of Hyodo using the precursor according to the teachings of Rhee because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of forming the disclosed low-k dielectric layer of Hyodo and art recognized suitability for an intended purpose has been recognized to be motivation to combine (MPEP 2144.07), and furthermore, because this would result in dielectric layer with dielectric constant of less than 2.6 (Rhee, column 1, lines 56 – 60).

Still, the combination of Hyodo and Rhee fail to expressly disclose wherein the deposited carbon doped dielectric layer has a carbon-carbon triple bond to silicon oxide bond ratio of about 0.05% to 20% based on FTIR pear area. However, the combination of Hyodo and Rhee teach wherein one of the reactants used is ethynyltrimethylsilane (Rhee, column 3, lines 38 – 52), which is a silicon containing compound having a carbon-carbon triple bond. Furthermore, the same materials are treated the same way

and therefore, the same results would be obtained. Accordingly, the combination of Hyodo and Rhee teach upon the claimed invention.

In reference to claims 2 and 20, the combination of Hyodo and Rhee teach wherein the radio frequency power has a high frequency component in the range of greater than 2 MHz (Hyodo, column 13, lines 35 – 36).

Hyodo in view of Rhee fail to expressly disclose wherein the radio frequency power has a high frequency component in the range of between about 2MHz and 60MHz.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in the combination of Hyodo and Rhee to form a dielectric layer at the overlapping low frequency and having the overlapping stress and dielectric constant to arrive at the claimed invention.

In reference to claims 3-5 and 21, the combination of Hyodo and Rhee teach controlling the frequency of the plasma deposition process to control the stress of the carbon doped oxide dielectric layer (Hyodo, column 13, lines 23 – 36), but fail to expressly disclose wherien the low frequency component of the radio frequency power has a power of between about 0.02 and 20 Watts/cm^2 of substrate surface area, pulsing the high frequency component of the radio frequency power delivered to the chamber at a frequency of between about 500 Hz and 10 kHz during deposition, and wherien the pulsing has a duty cycle between about 20 and 80%.

However, the selection of the radio frequency power is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a desired dielectric layer with a desired level of stress. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to arrive at the recited limitations through routinary experimentation.

In reference to claims 6 and 22, the combination of Hyodo and Rhee teach wherein the substrate is maintained at a temperature of between about 350^{o}C to 450^{o}C (Hyodo, column 12, lines 3 – 5).

Hyodo in view of Rhee fail to expressly disclose wherein the substrate is maintained at a temperature of between about 300 and 425 degrees C during depositing of the carbon doped oxide dielectric layer.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in the combination of Hyodo and Rhee to form a dielectric layer at the overlapping temperature to arrive at the claimed invention.

In reference to claim 7, the combination of Hyodo and Rhee teach wherein the substrate is maintained at a temperature of between about 350^{o}C to 450^{o}C (Hyodo, column 12, lines 3 – 5).

Hyodo in view of Rhee fail to expressly disclose wherein the substrate is maintained at a temperature of between about 300 and 400 degrees C during depositing of the carbon doped oxide dielectric layer.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in the combination of Hyodo and Rhee to form a dielectric layer at the overlapping temperature to arrive at the claimed invention.

In reference to claims 8 and 23, the combination of Hyodo and Rhee teach wherein the deposition chamber is maintained at a pressure of between about 1-10 Torr (Hyodo, column 9, lines 35 – 36).

The combination of Hyodo and Rhee fail to expressly disclose wherein the deposition chamber is maintained at a pressure of between about 2 and 20 Torr during deposition of the carbon doped oxide dielectric layer.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in the combination of Hyodo and Rhee to form a dielectric layer at the overlapping pressure to arrive at the claimed invention.

In reference to claim 9, the combination of Hyodo and Rhee teach wherein the deposition chamber is maintained at a pressure of between about 1-10 Torr (Hyodo, column 9, lines 35 – 36).

The combination of Hyodo and Rhee fail to expressly disclose wherein the deposition chamber is maintained at a pressure of between about 2 and 10 Torr during deposition of the carbon doped oxide dielectric layer.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in Hyodo and Rhee to form a dielectric layer at the overlapping pressure to arrive at the claimed invention.

In reference to claim 13, the combination of Hyodo and Rhee teach controlling low frequency power to control the stress within said layer (Hyodo, column 3, lines 31 – 34), controlling the residence time of said precursor to control the dielectric constant (Hyodo, column 9, lines 41 - 45) and adding additive gases to optimize the stress within said layer (Hyodo, column 13, lines 51 - 58).

The combination of Hyodo and Rhee fail to expressly disclose wherein the carbon doped oxide dielectric layer has a modulus of at least about 3GPa.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to control the radio frequency power, the residence time and additive gases to achieve the stress within said carbon doped dielectric layer because

the goal of the disclosed process is the same as that of the instant invention, namely a dielectric layer with controlled dielectric constant and strain.

In reference to claims 14 and 25, the combination of Hyodo and Rhee teach wherein the deposition chamber comprises a showerhead that serves as one plate of a plasma producing capacitor and a grounded block that serves as a second plate of the plasma producing capacitor (Hyodo, column 11, lines 1 – 17).

In reference to claims 15 and 26, the combination of Hyodo and Rhee teach wherein a separation gap between the showerhead and the block is maintained at a distance of 24 mm (Hyodo, column 15, lines 8 – 9).

The combination of Hyodo and Rhee fail to expressly disclose wherein a separation gap between the showerhead and the block is maintained at a distance between about 5 mm and 100 mm.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in Hyodo and Rhee to form a dielectric layer at the overlapping separation gap to arrive at the claimed invention.

In reference to claims 16 and 27, the combination of Hyodo and Rhee teach wherein the carbon doped oxide precursor is selected from the group consisting of alkylsilanes, alkoxysilanes, linear siloxanes and cyclic siloxanes (Hyodo, column 5, line 15 – column 8, line 40).

In reference to claim 18, the combination of Hyodo and Rhee teach wherein the carbon doped oxide precursor is a compound having a carbon-carbon double bond (Hyodo, column 5, line 15 – column 8, line 40).

In reference to claim 28, the combination of Hyodo and Rhee teach wherein the substrate is maintained at a temperature of between about 350°C to 450°C (Hyodo, column 12, lines 3 – 5).

The combination of Hyodo and Rhee fail to expressly disclose wherein the substrate is maintained at a temperature of between about 300 and 350 degrees C during depositing of the carbon doped oxide dielectric layer.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in Hyodo and Rhee to form a dielectric layer at the overlapping temperature to arrive at the claimed invention.

In reference to claims 29 and 30, Hyodo teaches a method of forming a low-k dielectric layer to reduce capacitance in multi layered wiring structures (Hyodo, column 1, lines 29 – 37) including the steps of providing a substrate in a deposition chamber (Hyodo, column 11, lines 2 – 5); providing a precursor having carbon-carbon double bonds to the deposition chamber (Hyodo, column 4, lines 9 – 12); igniting and maintaining a plasma in a deposition chamber using radio frequency power having high frequency and low frequency components (Hyodo, column 13, lines 13 – 19), wherein

about 1%-50% percent of total radio frequency power is provided by the low frequency component (Hyodo, column 13, lines 29 – 32), which has a frequency of between about 2 MHz or less (Hyodo, column 13, lines 32 – 33) and wherien the high frequency is greater than 2 MHz (Hyodo, column 13, lines 35 - 36); and depositing the low-k dielectric layer (Hyodo, column 4, lines 13 – 17) under conditions in which the dielectric layer has a stress labeled residual tensile or compressive stress of about 0 to about 300 MPa and wherein the dielectric constant of the carbon doped oxide dielectric layer is less than 4 (Hyodo, column 14, lines 65 – 67).

Hyodo further discloses controlling low frequency power to control the stress within said layer (Hyodo, column 3, lines 31 – 34), controlling the residence time of said precursor to control the dielectric constant (Hyodo, column 9, lines 41 - 45) and adding additive gases to optimize the stress within said layer (Hyodo, column 13, lines 51 - 58).

Hyodo fails to expressly disclose wherein the dielectric layer has a compressive stress less than about 50 Mpa, wherein the high frequency power is between about 2 MHz and 60 MHz, and wherein the dielectric constant is not greater than 3.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in Hyodo to form a dielectric layer at the overlapping low frequency, stress and dielectric constant to arrive at the claimed invention.

Still, Hyodo fails to expressly disclose wherein said low-k dielectric layer is a carbon doped oxide dielectric layer.

However, Hyodo teaches wherein said precursor comprises a silicon-containing hydrocarbon compounds having the general formula $Si_{\alpha}O_{\beta}C_{\chi}H_{\gamma}$, wherein α, β, χ and γ are integers (Hyodo, column 4, lines 35 – 36), wherein said silicon containing hydrocarbon comprises cyclic compounds having c=c bonds (i.e., unsaturated) (Hyodo, column 5, line 15 – column 6, line 20), linear compounds having c=c bonds (i.e., unsaturated) (Hyodo, column 6, line 29 – column 8, line 40). Furthermore, Hyodo teaches wherein said precursor further includes an additive gas such as ethene (C_2H_4) (Hyodo, column 13, lines 51 – 67) and a carrier gas selected from the group consisting of N_2, He, Ne and Ar (Hyodo, column 13, lines 41 – 42).

Having this in mind, the disclosed specification teaches wherein the precursors comprise silanes, alkylsilanes, alkoxysilanes, and cyclic siloxanes (page 12, paragraph [0047]) and small molecules having 2 to 6 carbon atoms and one or more carbon-carbon double bonds or carbon-carbon triple bonds (page 14, paragraph [0068]).

Therefore, in light of the specification, the precursors of Hyodo are labeled carbon doped precursors and the dielectric layer of Hyodo is labeled a carbon doped dielectric layer.

Therefore, Hyodo teaches the same materials (i.e., unsaturated silicon-containing hydrocarbon precursors) and said materials are treated the same way (i.e., plasma deposition process at overlapping conditions), the low-k dielectric layer is labeled carbon doped oxide dielectric layer.

Hyodo fails to expressly disclose pulsing the high frequency component of the radio frequency power delivered to the chamber at a frequency of between about 500 Hz and 10 kHz during deposition, and wherien the pulsing has a duty cycle between about 20 and 80%.

However, the selection of the radio frequency power is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a desired dielectric layer with a desired level of stress. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to arrive at the recited limitations through routinary experimentation.

Hyodo substantially teaches all aspects of the invention including wherein the carbon doped oxide precursor has the general formula $Si_{\alpha}O_{\alpha-1}R_{2\alpha-\beta+2}(OR')_{\beta}$, wherein α is an integer of 1-3, β can be 0 and R is C_{1-6} hydrocarbon attached to Si and R' is C_{1-6} unattached to Si.

Hyodo fails to disclose wherein the carbon doped oxide precursor has at least one carbon-carbon triple bond, such as ethynyltrimethylsilane. However, Rhee teaches a related method to form low dielectric constant layers teaches providing a substrate in a CVD chamber; introducing carbon doped oxide precursor into the chamber; and depositing said low-k dielectric layer, wherein said carbon doped oxide precursor is selected from a group including ethynyltrimethylsilane (Rhee, column 3, lines 38 – 52).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Hyodo and Rhee to enable depositing the low-k dielectric layer of

Hyodo using the precursor according to the teachings of Rhee because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of forming the disclosed low-k dielectric layer of Hyodo and art recognized suitability for an intended purpose has been recognized to be motivation to combine (MPEP 2144.07), and furthermore, because this would result in dielectric layer with dielectric constant of less than 2.6 (Rhee, column 1, lines 56 – 60).

In reference to claim 31, the combination of Hyodo and Rhee teach providing a substrate to a deposition chamber (Hyodo, column 11, lines 2 – 5); providing a precursor to the deposition chamber (Hyodo, column 4, lines 9 – 12), wherein the precursor comprises a molecule having at least one carbon-carbon double bond (Hyodo, column 5, line 15 – column 6, line 20 and column 6, line 29 – column 8, line 40); igniting and maintaining a plasma in a deposition chamber using high frequency radio frequency power greater than 2 MHz (Hyodo, column 13, lines 35 – 36); and depositing the carbon doped dielectric layer while the deposition chamber is maintained at a pressure of between about 1-10 Torr (Hyodo, column 9, lines 35 – 36), wherein the carbon doped oxide dielectric layer has a residual compressive stress of magnitude of about 0 to about 300 MPa and wherein the dielectric constant of the carbon doped oxide dielectric laver is less than 4 (Hyodo, column 14, lines 65 – 67), and wherein the deposition chamber comprises a showerhead that serves as one plate of a plasma producing capacitor and a grounded block that serves as a second plate of the plasma producing capacitor (Hyodo, column 11, lines 1 – 17), with a separation distance of about 24 mm between the showerhead and the block (Hyodo, column 15, lines 8 – 9).

The combination of Hyodo and Rhee fail to expressly disclose wherein the radio frequency power has a high frequency component in the range of between about 2MHz and 60MHz, wherein the deposition chamber is maintained at a pressure between about 2 and 20 Torr, wherein the carbon doped oxide dielectric layer has a residual tensile or compressive stress of magnitude less and about 50 MPs and a dielectric constant of less than 3, and wherein the separation distance is about 5 mm to 100 mm between the showerhead and the block.

However, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in Hyodo and Rhee to form a dielectric layer at the overlapping low frequency and separation gap to obtain a dielectric layer with overlapping stress and dielectric constant to arrive at the claimed invention.

Response to Arguments

5. Applicant's arguments filed 07/30/2008 have been fully considered but they are not persuasive.

Applicants argue, “…while Hyodo shows that these films may have compressive stress at dielectric constants between 3 and 4, it does not show that these films have dielectric constants of less than 3, as claimed…”.

In response to this argument, Hyodo discloses a method of forming low-k dielectric layers including controlling the deposition conditions, and the film stress, thereby obtaining a low-k dielectric layer with a dielectric constant of less than 3.5 (Hyodo, column 3, lines 26 - 35). Also, Hyodo discloses different examples using different processing conditions and precursors to obtain dielectric layers having different levels of stress (Hyodo, column 14, line 65 - column 16, line 53). The applicants assert that Hyodo fails to expressly dislcose the argued range. However, the range disclosed in Hyodo overlaps the claimed range. Furthermore, Hyodo envisioned forming dielectric layers at ranges of, for example, 2.7 or less preferably 2.4 or less (Hyodo, column 6, lines 22 - 27). Therefore, as mentioned hereinabove, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05. Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the process disclosed in Hyodo to form a dielectric layer at the overlapping low frequency, stress and dielectric constant to arrive at the claimed invention.

Also, Rhee teaches forming low-k dielectric layers using ethynyltrimethylsilane (Rhee, column 3, lines 38 – 52), which is one of the claimed materials used by the applicants (see claim 17), which would result in a dielectric layer with a dielectric constant of less than 2.6 (Rhee, column 1, lines 56 – 60).

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JULIO J. MALDONADO whose telephone number is (571)272-1864. The examiner can normally be reached on Mon-Fri, 8:00 A.M.-4:00 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Matthew Smith can be reached on (571)-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/George Fourson/
Primary Examiner, Art Unit 2823

/J. J. M./
Examiner, Art Unit 2823